B5 23. (NEW) An optical scanning apparatus, according to Claim 6, wherein said light source means comprises a plurality of light-emitting regions.--

REMARKS

Claims 1 through 23 are now pending in the application. Claim 2 has been cancelled without prejudice. Claims 1, 3 through 6, 8, 9, 19 and 20 have been amended to even more succinctly define the invention and/or to improve their form. Claims 21 through 23 are newly presented. Claims 1, 5 and 6 are independent.

As a preliminary matter, Applicant wishes to point out that Claim 6, which had previously been found to contain allowable subject matter, has been amended to include all of the features of Claim 1. Therefore, Claim 6 should now be allowed.

Claims 1-5, 8-9, 19/(1-5,8-9) and 20/(1-5,8-9) are rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,418,639 (Yamazaki). In light of the foregoing amendments and following remarks, the rejection is respectfully traversed.

Claim 1 as amended recites, in relevant part, an optical scanning apparatus comprising scanning optical means including a plurality of sagittal asymmetric change surfaces in which curvatures in the sagittal direction change on an asymmetric basis in the meridional direction with respect to the optical axis of the scanning optical means, and a magnitude relation differs among curvatures in the sagittal direction at respective positions in the meridional direction with respect to the optical axis.

Claim 5 as amended recites, in relevant part, an optical scanning apparatus comprising scanning optical means including a plurality of sagittal asymmetric change

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surfaces in which curvatures in the sagittal direction change on an asymmetric basis in the meridional direction with respect to the optical axis of the scanning optical means, wherein in at least one surface of the sagittal asymmetric change surfaces the curvatures in the sagittal direction have an inflection point on one side of the optical axis in the meridional direction.

By the above arrangements, the asymmetry of the sub-scanning magnifications and the curvature of field in the sub-scanning direction can be corrected effectively even when the apparatus must contend with wide angles of view and high sub-scanning magnifications. These corrections permit the spot size in the sub-scanning direction to be kept constant at all of the scanning positions in the effective scanning area.

U.S. Patent No. 5,418,639 (Yamazaki) relates to a light beam scanning device. Applicant submits that at most, Yamazaki discloses only one surface (i.e., surface number 4) that has a characteristic whereby a magnitude relation differs among curvatures in the sagittal direction at respective positions in the meridional direction with respect to the optical axis, as recited in Claim 1. As such, Yamazaki does not disclose a plurality of such surfaces and does not anticipate Claim 1.

With regard to Claim 5, based on equation 1 (Col. 5, lines 64 to 70) and the coefficient values disclosed in the six embodiments, Applicant submits that Yamazaki teaches no inflection point in any of the lens curvatures. Although Yamazaki discloses a plurality of non-symmetrical surfaces at Col. 8, lines 19 to 20, there is no disclosure of what shape or arrangement such surfaces would take, and there is also apparently no disclosure of an inflection point. Applicant submits that because Yamazaki does not teach

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an inflection point, Yamazaki cannot teach correcting both of (i) image magnification in the sub-scanning direction so that the image magnification is a constant value and (ii) the curvature of field in the subscanning direction. Indeed, Yamazaki appears directed to correcting only the curvature of field, and fails even to mention image magnification in the sub-scanning direction. Accordingly, Applicant respectfully submits that Yamazaki does not anticipate every feature recited in amended Claim 5, and requests withdrawal of the rejection.

In light of the foregoing amendments and remarks, Applicant submits that independent Claims 1 and 5 are in condition for allowance. Independent Claim 6 has been previously found to contain allowable subject matter.

The dependent claims are allowable for the reasons that their respective parent Claims 1, 5 and 6 are allowable, as well as for the additional features each dependent claim recites. Therefore, passage to issue of the present application is respectfully requested.

Favorable consideration hereof and early passage to issue of the present application are earnestly solicited.

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Applicant's undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our New York office at the below-listed address.

Respectfully submitted,

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VERSION WITH MARKINGS SHOWING CHANGES MADE TO CLAIMS

1. (Twice Amended) An optical scanning apparatus comprising:

light source means;

deflecting means;

entrance optical means for guiding light emitted from the light source means[,] to the deflecting means[,]; and

scanning optical means for forming an image of the light reflectively deflected by the deflecting means, on a surface to be scanned,

wherein the scanning optical means comprises a plurality of sagittal asymmetric change surfaces in which curvatures in the sagittal direction change on an asymmetric basis in the meridional direction with respect to the optical axis of the scanning optical means, and

wherein a magnitude relation differs among curvatures in the sagittal direction at respective positions in the meridional direction with respect to the optical axis.

3. (AMENDED) The optical scanning apparatus according to Claim [2] 1, wherein [said sagittal deformation surfaces comprise two or more surfaces in which the] curvatures in the sagittal direction at the respective positions in the meridional direction with respect to the optical axis become large or small on the same side.

4. (AMENDED) The optical scanning apparatus according to Claim [2] 1, wherein in at least one surface of said asymmetrical sagittal [deformation] change surfaces the curvatures in the sagittal direction become large on the side of said light source means with respect to the optical axis.

5. (AMENDED) [The optical scanning apparatus according to Claim 1,] An optical scanning apparatus comprising:

light source means;

deflecting means;

entrance optical means for guiding light emitted from the light source means to the deflecting means; and

scanning optical means for forming an image of the light reflectively deflected by the deflecting means, on a surface to be scanned,

wherein the scanning optical means comprises a plurality of sagittal asymmetric change surfaces in which curvatures in the sagittal direction change on an asymmetric basis in the meridional direction with respect to the optical axis of the scanning optical means, and

wherein in at least one surface of said sagittal asymmetric change surfaces the curvatures in the sagittal direction have an inflection point [only] on one side of the optical axis in the meridional direction [with respect to the optical axis].

N/w ?

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6. (AMENDED) [The optical scanning apparatus according to Claim 1,] An optical scanning apparatus comprising:

light source means;

deflecting means;

entrance optical means for guiding light emitted from the light source means to the deflecting means; and

scanning optical means for forming an image of the light reflectively deflected by the deflecting means, on a surface to be scanned,

wherein the scanning optical means comprises a plurality of sagittal asymmetric change surfaces in which curvatures in the sagittal direction change on an asymmetric basis in the meridional direction with respect to the optical axis of the scanning optical means, and

wherein said scanning optical means comprises a plurality of fθ lenses, an fθ lens located closest to the deflecting means [out of] among said plurality of fθ lenses has a negative[,] refractive power in the [sub-scanning] sagittal direction, and an fθ lens located closest to the surface to be scanned, among said pluarlity of fθ lenses, has a positive[,] refractive power in the [sub-scanning] sagittal direction.

8. (AMENDED) The optical scanning apparatus according to Claim 1, wherein the following condition is satisfied:

$k/W \leq 0.6$,

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where k is an fθ coefficient of said scanning optical means, and W is an effective scanning width [on] of said surface to be scanned.

9. (AMENDED) The optical scanning apparatus according to Claim 1, wherein the following condition is satisfied:

$|\beta_s| \geq 2$,

where β_s is a lateral magnification in the sub-scanning direction of said scanning optical means.

19. (TWICE AMENDED) An image-forming apparatus comprising:

the scanning optical apparatus as set forth in [either] any one of Claims [1 to 18] 1, 5 and 6;

a photosensitive body located at [said] the surface to be scanned[,];

a developing unit for developing an electrostatic, latent image formed on said photosensitive body with the light under scan by said scanning optical apparatus, into a toner image[,];

a transfer unit for transferring [said] the developed toner image onto a transfer medium[,] ; and

a fixing unit for fixing the transferred toner image on the transfer medium.

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20. (TWICE AMENDED) An image-forming apparatus comprising the scanning optical apparatus as set forth in [either] any one of Claims [1 to 18] 1, 5 and 6; and

a printer controller for converting code data supplied from an external device, into an image signal and supplying the image signal to said scanning optical apparatus.

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VERSION WITH MARKINGS SHOWING CHANGES MADE TO SPECIFICATION

The paragraph at page 1, lines 17-27 has been amended as follows.

In the optical scanning apparatus such as the laser beam printers, the digital copiers, etc. heretofore, the image information was recorded in such a manner that the light optically modulated according to an image signal and outputted from the light source means was periodically deflected by the deflecting means[, for example consisting] which consisted of, for example, a polygon mirror, and was converged in a spot shape on a surface of a photosensitive recording medium by the scanning optical means with the fθ characteristics to optically scan the surface.

The paragraph starting at page 2, line 25, and ending at page 3, line 11, has been amended as follows.

[For compactifying] To make the apparatus from the optical deflector 95 to the surface to be scanned 97 [herein] more compact, it is necessary to effect good correction for optical performance of the fθ lens 96 throughout wide angles of view. For example, Japanese Patent Application Laid-Open No. 7-113950 discloses an example of correction for curvature of field (image positions) in the sub-scanning direction and at wide

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angles of view by provision of only one surface wherein curvatures in the sagittal direction vary on an asymmetric basis with respect to the optical axis and wherein magnitude relations of curvatures in the sagittal direction are different [between] on the upper and lower sides of the optical axis.

The paragraph at page 3, lines 12-27 has been amended as follows.

There was, however, the problem that nonuniformity of lateral magnification (which will also be referred to hereinafter as "sub-scanning magnification") in the sub-scanning direction appeared prominent at wide angles of view and even if the image positions in the sub-scanning direction were corrected the spot size would vary in proportion to sub-scanning magnifications at respective scanning positions. Further, in the case of the optical scanning apparatus using multiple beams, they suffered <u>from</u> the problem that with deviation of the sub-scanning magnifications from a fixed value, line pitch intervals in the sub-scanning direction varied at every scanning position on the surface to be scanned[,] during the optical scanning of [the] <u>that</u> surface [to be scanned with the plurality of beams], so as to result in irregular pitch.